Surgical Chair for Percutaneous Spinal Catheter Insertion

Priority Claim

[0001] The present application claims priority from US 60/391,085, filed June 25, 2002, the contents of which are incorporated herein by reference.

Field of the Invention

[0002] The present invention relates generally to catheters and more particularly relates to a surgical chair and a spinal catheter kit for percutaneous spinal catheter insertion via lumbar puncture.

Background of the Invention

[0003] Spinal catheter insertion may be used for cerebrospinal fluid (CSF) pressure monitoring and controlled CSF drainage for the diagnosis of adult hydrocephalus (See, for example, discussions in Williams MA, Razumovsky AY, Hanley DF. Comparison of Pcsf monitoring and controlled CSF drainage to diagnose normal pressure hydrocephalus. Acta Neurochir 1998;71:328-330. and, Haan J, Thomeer RT. Predictive value of temporary external lumbar drainage in normal pressure hydrocephalus. Neurosurgery 1988;22:388-391. The contents of which are incorporated herein by reference.)

[0004] Existing spinal catheter insertion techniques are based on traditional lumbar puncture (LP) and spinal anesthetic techniques, with patients either in the lateral decubitus or seated positions. (See, for example, Patten J. Neurological Differential Diagnosis. 2 ed. London:Springer-Verlag, 1995:273; Lee JA, Atkinson RS, Watt MJ. Sir Robert Macintosh's Lumbar Puncture and Spinal Analgesia: Intradural and Extradural. Edinburgh:Churchill Livingstone, 1985:159; Barnett R.Nathan. Cerebrospinal Fluid and

Intracranial Pressure. In: Goetz CG, Pappert EJ, eds. Textbook of Clinical Neurology [online]. Philadelphia: W.B. Saunders, 1999:480-481. Available at:

http://home.mdconsult.com/das/book/13710379/view/889. Accessed October 10, 2001; and, Lund PC. Principles and Practice of Spinal Anesthesia. Springfield, IL:Charles C. Thomas, 1971:304 The contents of all of these references are incorporated herein by reference.) Because adult hydrocephalus predominantly affects persons between the ages of 60 and 90, the LP in the lateral decubitus position may be difficult because it is hard for patients to maintain the proper position due to discomfort or arthritic changes of the spine that impede their ability to flex, or because it is difficult to keep their pelvis and shoulders perpendicular to the surface of the bed or examination table, resulting in rotation the spine. (See Patten J. Neurological Differential Diagnosis. 2 ed. London:Springer-Verlag, 1995:273, the contents of which is incorporated herein by reference.)

[0005] Attempts to perform LPs with patients in the seated position are often difficult in the hospital setting because of the lack of a stable, safe platform for the patient. A commonly used technique, though apparently undocumented in peer-reviewed literature, is to have the patient sit on the edge of the bed while flexing and leaning on an over-bed table with a pillow on it. While this approach may improve flexion of the lumbosacral spine, it carries the risk that the over-bed table (which is on wheels) can move forward, potentially causing the patient to fall, or sideways, potentially misaligning the spine. This technique further requires the assistance of an additional person or persons to help maintain the patient's position, to prevent the over-bed table from moving, or to assure that the patient's breathing is not obstructed because the face is in the pillow. The presence of an assistant to stabilize the seated patient for lumbar puncture is illustrated in two spinal anesthesia texts. (See Lee JA, Atkinson RS, Watt MJ. Sir Robert Macintosh's Lumbar Puncture and Spinal Analgesia: Intradural and Extradural. Edinburgh:Churchill Livingstone, 1985:159. See also Lund PC. Principles and Practice of Spinal Anesthesia. Springfield, IL:Charles C. Thomas, 1971:304, the contents of both of which are

incorporated herein by reference. See also Williams MA: Seated LP using a massage chair Page 2)

Summary of the Invention

[0006] It is an object of the invention to provide a novel surgical chair and method for its use that obviates or mitigates at least one of the above-identified disadvantages of the prior art.

[0007] An aspect of the invention provides a surgical chair comprising, a frame and a seat attached to the frame. The chair also comprises a face-rest attached to the frame, and a chest-pad attached to the frame at a position between the seat and the face-rest. The seat, face-rest and chest-pad are mounted on the frame such that when a patient sits in the seat and the patient's face rests in the face-rest then a desired portion of the patient's spine is presented in an ergonomic manner to a medical professional so that the professional can perform a procedure on the spine. The seat and face-rest can be adjustable to accommodate patient's of different sizes. The chair can further comprise at least one knee-pad attached to the frame for supporting the patient's knees when the patient is seated. The knee-pads can be removable and/or adjustable.

[0008] The frame can support the seat, face-rest, chest-pad and knee-pads in a particular configuration such that the patient can slide sideways into a seated position within the chair without raising his or her leg over the frame.

[0009] The chair can further comprise an arm rest. The arm rest can be adjustable to allow the patient's arms to be positioned at substantially the same height as the patient's chest.

[0010] The face rest of the chair can be donut shaped to support the periphery of the patient's face while providing a pathway for breathing through a centre of the donut shape.

[0011] The desired portion of the patient's spinal is typically the patient's lumbosacral spine.

[0012] Another aspect of the invention provides a prepackaged sterile tray of parts for use in performing a spinal catheter insertion comprising a lumbar puncture tray, a separate spinal catheter tray, and a separate collection of gauze sponges, iodine solution, sutures, needle holders, and scissors.

[0013] Another aspect of the invention provides a spinal catheter that can be packaged as part of the tray of parts or separately therefrom. The catheter has a narrow end for insertion into a lumbar puncture and a waist at a predetermined distance from the narrow end, the waist being wider than the narrow end such that the waist provides a seal between an exterior of the catheter and the puncture.

Brief Description of the Drawings

[0014] Preferred embodiments of the present invention will now be explained, by way of example only, with reference to the attached Figures in which:

Figure 1 shows an isometric view of a surgical chair in accordance with an embodiment of the invention;

Figure 2 shows a side view of the surgical chair shown in Figure 1;

Figure 3 shows the chair of Figure 2 with a patient seated thereon;

Figure 4 shows a rear view of the chair and patient shown in Figure 3;

Figure 5 shows an isometric view of a surgical chair in accordance with another embodiment of the invention;

Figure 6 shows a side view of the chair and patient shown in Figure 5;

Figure 7 shows a tray of parts for use in performing a spinal catheter insertion in accordance with another embodiment of the invention;

Figure 8 is an isometric view of the tray of Figure 7;

Figure 9 shows the guidewire of Figure 7 in when removed from the tray of Figure 7; and

Figure 10 shows a tapered spinal catheter in accordance with another embodiment of the invention.

Detailed Description of the Invention

[0015] Referring now to Figures 1-4, a surgical chair for use in performing a seated lumbar puncture in accordance with an embodiment of the invention is indicated generally at 20. A presently preferred surgical chair is a suitably configured Ergo Pro Massage chair sold by Stronglite, Inc. 255 Davidson Street Cottage Grove Oregon 97424 U.S.A., and shown as chair 20 in Figure 1. In a presently preferred embodiment, chair 20 has an aluminum tubular construction capable of supporting about 1200 pounds (545 Kg) static weight. Chair 20 comprises an aluminum tubular frame 24 that supports a substantially donut-shaped face rest 28 which is intended to support a patient's head when facing downwards, such that the periphery of the patient's face is supported by face rest 28, while the hollow centre provides an unobstructed airway to allow the patient to comfortably breathe, see and speak during the procedure. Chair 20 further includes a chest-pad onto which a patient can lean his or her chest while placing their head face-down on face rest 28.

[0016] Chair 20 also includes an arm rest 36 that is supported by frame 24, which the patient can use to place his or her arms while the procedure is being performed. Frame 24 of chair 20 also supports a seat 40 and knee pads 44. In sum, the various components of chair 20 allow a patient to rest comfortably while facing forward, and thereby present the lumbar region of the patient to a surgeon (or other medical

professional) who will perform a spinal catheter procedure, the details of which will be discussed in greater detail below.

[0017] Preferably, face rest 28, chest pad 32, arm rest 36, seat 40 and knee pads 44 are all adjustable to comfortably accommodate patients of various sizes, heights and weights, and conditions of the patient. For example, the height and angle of face rest 28 are adjustable to accommodate differences in patient height or ability to flex the neck. Arm rest 36 allows the arms to rest comfortably at approximately the level of the heart. Further, it is presently preferred that knee pads 44 can be removable. When present, knee pads 44 can be used to permit the patient to rest with both hips and knees in flexion. When knee pads 44 are removed chair 20 can then accommodate patients with limited knee mobility.

[0018] As best seen in Figures 3 and 4, when seated in chair 20, the patient faces forward and the chair is adjusted for comfortable flexion of the hips and lumbosacral spine, thereby ergonomically presenting the lumbosacral spine, identified in Figure 3 generally at 50 to the medical professional. It will now be understood that face rest 28, chest pad 32, arm rest 36, seat 40 and knee pads 44 of chair 20 are adjusted so as to achieve a desired level of comfort for the patient, while also presenting lumbosacral spine 50 in an ergonomically desirable manner to the medical professional.

[0019] Referring now to Figures 5 and 6, a surgical chair in accordance with another embodiment of the invention is indicated generally at 20a. Chair 20a includes a similar structure to chair 20 shown in Figures 1-4, and thus bears like reference numerals to its various components, except that components in chair 20a are followed with the letter "a". Thus, chair 20a is substantially the same as chair 20, except that frame 24a and knee rests 44a do not form a cross spar (as found in chair 20) that impedes sideways movement of the patient's legs across the center line XX of the chair 20 as seen in Figure 4, when the patient slides into chair 20a from the side. As best seen in Figures 5 and 6, this embodiment of the chair will allow patients to slide onto the chair from the side, as if sliding across a bench, allowing them to attain the proper position for the spinal catheter

procedure without having to straddle the seat or cross spar, or otherwise flex or bend their legs over the cross spar so as to attain the proper position for the procedure. Put in other words, the patient can slide sideways into chair 20a without having to raise his or her leg over frame 24a. Chair 20a is thus suitable for epidural anesthesia with or without epidural catheter insertion for pregnant women for the purpose of labor and delivery, or for other patients in need of spinal anesthesia.

[0020] In another embodiment of the invention, chair 20, chair 20a or a combination or variation of components thereof are made from materials such that frame 24, seat 40, knee pads 44, chest pad 32, arm rest 36, and face rest 28 are constructed of radioluscent materials (e.g. wood, graphite composite, or structurally sound polymers) so that the chair is invisible under an imaging beam, but lumbar puncture and associated catheter procedures are visible and can thus be performed under fluoroscopic guidance (or the like) as necessary.

[0021] In another embodiment of the invention, there is provided a sterile tray of parts for use in performing a spinal catheter insertion technique using the surgical chair shown in Figures 1-6. The tray of parts preferably contains the items listed in Table 1. An exemplary configuration of the tray is shown in Figures 7 and 8, and indicated generally at 90.

Table 1

Reference Number of Item or Tray location	**Part Name**	**Quantity**	**Description or Source (if applicable)**
100	Lumbar puncture tray	1	Allegiance Healthcare Corp., McGaw Park, IL 60085; #4301C
104	Spinal Catheter tray	1	Medtronic PS Medical, Goleta, California; #27304

Reference Number of Item or Tray location	Part Name	Quantity	Description or Source (if applicable)
	tray		Goleta, California; #27304
110	Gauze sponges	10	Kendall Curity, 3x3" ; #1903
112	2% tincture Iodine Solution	50 ml	Cumberland Swann; Smyrna, TN 37167
108	Sutures	1	USS/DG; Sofsilk; #SS-685; 45 cm, C-15 cutting needle
108	Needle Holder	1	Acme Healthcare; Medical Action Industries Co.; Arden, NC
108	Scissors	1	Acme Healthcare; Medical Action Industries Co.; Arden, NC
108	Paper Drape	1	Shaped to expose lumbar spine 50 and cover the surrounding area. Includes an adhesive strip.
108	Local Anesthetic with 1 or 2% Lidocaine Solution	50ml	Abbott Laboratories; North Chicago, IL 60064
116	Closed tip lumbar catheter		Medtronic PS Medical, Goleta, California
120	16 Gauge Needle	1	Becton Dickinson & Co.; Franklin Lakes, NJ 07417

Reference Number of Item or Tray location	Part Name	Quantity	Description or Source (if applicable)
124	14 Gauge Tuohy Needle	1	Medtronic PS Medical, Goleta, California
128	Luer Hub with Cap		
108	Transparent Adhesive Dressing		Op Site; Smith & Nephew Medical Ltd; Hull HU3 2BN England
132	10cc Syringe	1	
136	3cc Syringe	1	
140	Guidewire	1	

[0022] Having appropriately seated the patient on chair 20, the anatomical landmarks (iliac crests and spinous processes) are indicated with a surgical marking pen on lumbosacral spine 50. Personnel present to perform or assist wear sterile cap and masks, and the person inserting the lumbar catheter wears cap, mask, and sterile gown and gloves. Intravenous prophylactic antibiotics (1 gram oxacillin or 600 mg clindamycin) are administered during the procedure. The lumbosacral spine 50 area of the patient's back is prepared with 2% tincture of iodine solution. A sterile paper drape with an adhesive strip is attached at the lower margin of the sterile field.

[0023] Local anesthetic with lidocaine is administered along the planned puncture track of lumbosacral spine 50, as well as adjacent to the spinous processes for a field block of the recurrent spinal nerves (For further discussion on this step, see Wilkinson

HA. "Field block anesthesia for lumbar puncture." JAMA 1983;249:2177, the contents of which are incorporated herein by reference.)

[0024] A closed tip lumbar catheter is prepared with a guidewire advanced to within 3-4 cm of the tip of the catheter, leaving the tip flexible. A suitable closed tip lumbar catheter is available from Medtronic PS Medical, Goleta, California. The skin may be punctured to a depth of 2-4 mm with a 16-Ga needle to provide easier insertion of the 14-Ga Tuohy needle. The Tuohy needle is advanced with the bevel directed either to the right or to the left so that it is parallel to the longitudinal fibers of the lumbar spinal dura. Once CSF is encountered, the needle is rotated so the bevel is directed cephalad.

[0025] Next, the stylet of the Tuohy needle is withdrawn and the catheter with guidewire is rapidly inserted so that 10-15 cm of catheter are inserted beyond the needle tip. The needle is withdrawn. The guidewire is withdrawn by grasping the catheter where it exits the skin to prevent its withdrawal while the guidewire is carefully removed in its entirety. The spinal catheter is then trimmed to an appropriate length so that a Luer hub with cap can be attached. A small area of skin on the flank is anesthetized with lidocaine, and the Luer hub is secured to the skin with a silk suture, thereby providing strain relief for the spinal catheter if tension is placed on the Luer hub. Finally, the catheter site is covered with a transparent adhesive dressing, and the spinal catheter is connected at the Luer hub to tubing that attaches to a pressure transducer, controlled CSF drainage apparatus (or system), or a combination of the two.

[0026] Referring now to Figure 10, a spinal catheter in accordance with another embodiment of the invention is shown at 116a. Spinal catheter 116a is essentially the same as catheter 116, particularly in its length, except that spinal catheter 116a is tapered. The narrow end 180 of spinal catheter 116a is smaller in diameter than the touhy needle. Spinal catheter 116a gradually widens to a waist 184 that is slighter greater in diameter than the touhy needle. Waist 184 can be about two to eight inches in length from narrow end 180, or it can be about three to seven inches from narrow end 180, or, more preferably it can be about six inches from narrow end 180. Narrow end 180 of catheter

116a is inserted into the puncture, until waist 184 reaches the opening of the puncture. By so doing, a seal is formed around the exterior of catheter 116a and the puncture, thereby reducing leakage from the puncture. Such a seal provides a number of advantages, including the ability to attach a device for measuring CSF pressure. With the seal, a more accurate measurement of CSF pressure can be made than that with certain prior art catheters. While not necessary, catheter 116a is preferably coated with an infection resistant layer and/or an adhesion resistant layer.

[0027] While only specific combinations of the various features and components of the present invention have been discussed herein, it will be apparent to those of skill in the art that desired subsets of the disclosed features and components and/or alternative combinations of these features and components can be utilized, as desired. For example, the above-described embodiments of surgical chairs and kit of parts and technique can be used for standard diagnostic lumbar puncture, therapeutic lumbar puncture, spinal catheter insertion, or epidural catheter insertion for spinal anesthesia or other purposes that will occur to those of skill in the art.

[0028] The present invention provides a novel spinal catheter and method for its insertion via seated lumbar puncture using a surgical chair. It is the inventors' experience that a successful spinal catheter insertion can be achieved in certain patients that do not have physical impairments that might restrict their ability to physically position themselves on the surgical chair in a presently preferred embodiment. The surgical chair provides a stable, substantially safe platform for patients, and reduces the need for additional personnel to maintain the patient's position. The seated position provides for good alignment of the spinous processes, improving the chances for successful lumbar puncture and spinal catheter insertion. The surgical chair can provide a stable platform that permits patients to maintain proper position with reduced effort, and without the need for additional personnel to keep the patient's legs tucked toward the chest in the decubitus position, or to prevent an over-bed table from rolling if seated on the edge of the bed. The face rest can reduce and even prevent breathing obstruction that occurs when patients lean on an over-bed table with a pillow on it. The seated position also

makes it much more likely that the spinous processes will be aligned without the rotation of the spine that can occur in the lateral decubitus position. The present invention can reduce the procedure time by up to about 50-75% over prior art procedures for insertion of a spinal catheter, as typically about 30 minutes or less is required for most patients for the entire procedure.